

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	e reference FOR FURTHER ACTION See Form PCT/IPEA/416								
300560WO/DJW/DG	PORTORINER ACTION	Sec Point	CITEM410						
International application No.	International filing date (day/n	ionth/year)	Priority date (day/month/year)						
PCT/IB2002/003198	21.06.2002								
International Patent Classification (IPC) of	r national classification and IPC								
H04Q 7/38, G01S 5/14 // G01S 5/00									
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Applicant									
Nokia Corporation et	al								
This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.									
2. This REPORT consists of a total of	of 3 sheets, inclu	ding this cover	sheet.						
This report is also accompanied by		•							
	Participation, comprising.								
a. (sent to the applicant	and to the International Bureau) a total of 6	sheets, as follows:						
sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).									
sheets which s	supersede earlier sheets, but whi	ich this Authori	ity considers contain an amendment that goes						
beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.									
b. (sent to the Internation	b. (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s))								
readable form only as			and/or tables related thereto, in computer of Sequence Listing (see Section 802 of the						
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4. This report contains indications re	lating to the following items:								
	the report								
Box No. II Priority									
Box No. III Non-esta	ablishment of opinion with rega	rd to novelty, i	nventive step and industrial applicability						
	unity of invention	•							
	-	with record to	novelty, inventive step or industrial						
applicab	ility; citations and explanations								
Box No. VI Certain	documents cited								
Box No. VII Certain	Box No. VII Certain defects in the international application								
Box No. VIII Certain observations on the international application									
Date of submission of the demand	Date	of completion of	of this report						
	or completion (or this report							
21.01.2004		22 00 2004							
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Name and mailing address of the IPEA/SE Patent- och registreringsverket	Autho	orized officer							
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Form PCT/IPEA/409 (cover sheet) (Januar	y 2004)	HOUSE INU. +46	0 102 23 00						

Box	k No. I	Ba	Basis of the report					
1.	With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.							
			his report is based on a translation from the original language into the following language, which is the language of a translation furnished for the purposes of:					
			international search (under Rules 12.3 and 23.1(b))					
			publication of the international application (under Rule 12.4)					
			international preliminary examination (under Rules 55.2 and/or 55.3)					
2.	furnisi	hed to the e not an	to the elements of the international application, this report is based on (replacement she the receiving Office in response to an invitation under Article 14 are referred to in this report annexed to this report):	ets which have been as "originally filed"				
		the inte	nternational application as originally filed/furnished					
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		Ш	the description, pages					
			the claims, Nos.					
			the drawings, sheets/figs					
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		П	any table(s) related to the sequence listing (specify):					
4.		This remade, s	report has been established as if (some of) the amendments annexed to this report and listed, since they have been considered to go beyond the disclosure as filed, as indicated in the Supp	below had not been plemental Box (Rule				
			the description, pages					
			the claims, Nos.					
			the drawings, sheets/figs					
			the sequence listing (specify):					
			any table(s) related to the sequence listing (specify):					
	_		ies, some or all of those sheets may be marked "superseded."					

Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.	Statement			
	Novelty (N)	Claims	1-34	YES
		Claims		NO NO
	Inventive step (IS)	Claims	_1-34	YES
		Claims		NO NO
	Industrial applicability (IA)	Claims	1-34	YES
		Claims		NO

2. Citations and explanations (Rule 70.7)

Documents cited in the International Search Report:

D1: WO0199444 A1 D2: US6415155 B1 D3: WO0217669 A1 D4: US5260943 A

D5: "Experimental performance of methods to estimate the location of legacy handsets in GSM" (Spirito et al, 2001)

The cited documents represent the general state of the art. The invention defined in claims 1-34 is not disclosed by any of these documents.

The cited prior art does not give any indication that would lead a person skilled in the art to the claimed method and network device for determining the path of a signal between a donor network element and a remote station. Therefore, the claimed invention is not obvious to a person skilled in the

Accordingly, the invention defined in claims 1-34 is novel and is considered to involve an inventive step. The invention is industrially applicable.

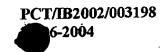
Claims

- A method of determining the path of a signal between a donor network element (14) and a remote station (20), the donor network element (14) being associated with at least one repeater (16, 18), comprising the steps of: receiving at the remote station (20) a plurality of signals associated with a plurality of network elements (10, 12, 14); calculating an estimate of the distance between the remote station (20) and each network element (10, 12, 14), including an estimate of the distance between the remote station (20) and each repeater (16, 18) associated with the donor network element (14); determining the one of said estimates of the distance between the donor network element (14) and at least one associated repeater (16, 18) and remote station (20) which most closely approximates to the distance between the other network elements (10, 12) and the remote station (20); and selecting that donor network element/repeater to be the source of the signal.
- 2. A method according to claim 1, wherein the step of calculating an estimate of the distance between the remote station (20) and each network element (10, 12, 14) comprises: selecting each one of the donor network elements (14) and at least one repeater (16, 18) in turn as the source of the signal; and performing said calculating step for only the selected one of the donor network element (14) and at least one repeater (16, 18).
 - 3. A method according to claim 1 or claim 2 wherein the step of calculating the estimate of the distance includes estimating the location of the remote station (20) and thereby estimating an actual distance between each donor network element/repeater and the remote station (20).

4. A method according to claim 3 wherein the step of calculating the estimate of the distance includes measuring physical quantities at the remote station (20), and thereby estimating a model distance between each network element/repeater and the remote station (20).

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- 5. A method according to claim 4 wherein the measured physical quantity includes the measurement, at the remote station (20), of one or all of: a time delay in a received signal; attenuation in a received signal or received signal strength.
- 6. A method according to claim 5 wherein the step of estimating the actual distances further comprises summing the estimated actual distances.
- 7. A method according to claim 6 wherein the step of 15 estimating the model distances further comprises summing the model distances.
 - 8. A method according to claim 7 further including calculating a scale factor in dependence on the summed actual and model distances.
- 20 9. A method according to claim 8 wherein the scale factor is determined to adapt the scaled sums to be equal.
 - 10. A method according to claim 9 wherein the scale factor is determined by dividing the summed actual estimates by the summed model estimates.
- 25 11. A method according to claim 9 or claim 10 wherein the model distances estimates are modified in dependence on said scale factor to produce a set of modified model distances.



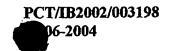
- 12. A method according to claim 11 wherein the model distances are scaled by the scaling factor to produce the modified model distances.
- 13. A method according to claim 12 further including calculating a difference value for each donor network element (14) and at least one repeater (16, 18) by summing the difference between each estimate and each modified model estimate obtained for each respective donor network element (14) and at least one repeater (16, 18).
- 10 14. A method according to claim 13 wherein, the signal is determined to be transmitted from the donor network element (14) or at least one repeater (16, 18) having the lowest difference value.
- 15. A method according to any one of claims 1 to 14
 15 wherein a plurality of signals are from a donor network
 element (14), wherein all steps are repeated for each such
 signal to determine a source of each signal.
- 16. A method according to any preceding claim, further comprising the step of calculating the location of the remote station (20) in dependence on the determined source of the signal.
 - 17. A method according to any preceding claim wherein the remote station (20) is a mobile station and the donor network element (14) is a donor base station.
- 25 18. A network device (20) adapted to determine the path of a signal between a donor network element (14) and a remote station (20), the donor network element (14) being associated with at least one repeater (16, 18), comprising means for calculating an estimate of the distance between



the remote station (20) and each network element (10, 12, 14), including an estimate of the distance between the remote station (20) and each repeater (16, 18) associated with the donor network element (14), based on a plurality of signals received at a mobile station (20); means for determining the one of said estimates of the distance between the donor network element (14) and at least one associated repeater (16, 18) and remote station (20) which most closely approximates to the distance between the other network elements (10, 12) and the remote station (20); and means for selecting that donor network element/repeater to be the source of the signal.

19. A network device (200) according to claim 18, wherein the remote station (20) is a mobile station and the 15 network element (10, 12, 14) is a base station.

- 20. A network device (200) according to claim 18 or claim 19 wherein the means for calculating an estimate of the distance between the remote station (20) and each network element (10, 12, 14) includes: means for selecting each one of the donor network elements (14) and at least one repeater (16, 18) in turn as the source of the signal; and means for performing said calculating step for only the selected one of the donor network element (14) and at least one repeater (16, 18).
- 25 21. A network device (200) according to any one of claims 18 to 20 wherein the means for calculating the estimate of the distance includes means for estimating the location of the remote station (20) and thereby estimating an actual distance between each donor network 30 element/repeater and the remote station (20).



- 22. A network device (200) according to claim 21 wherein the means for calculating the estimate of the distance includes means for measuring physical quantities at the remote station (20), and thereby estimating a model distance between each network element/repeater and the remote station (20).
- 23. A network device (200) according to claim 22 wherein the measured physical quantity includes the measurement, at the remote station (20), of one or all of: a time delay in a received signal; attenuation in a received signal or received signal strength.
- 24. A network device (200) according to claim 23 wherein the means for estimating the actual distances further comprises means for summing the estimated actual distances.

- 25. A network device (200) according to claim 24 wherein the means for estimating the model distances further comprise means for summing the model distances.
- 26. A network device (200) according to claim 2520 further including means for calculating a scale factor in dependence on the summed actual and model distances.
 - 27. A network device (200) according to claim 26 wherein the means for calculating the scale factor is adapted to convert the scaled sums to be equal.
- 25 28. A network element (200) according to claim 27 wherein the scale factor is determined by dividing the summed actual estimates by the summed model estimates.
 - 29. A network device (200) according to claim 27 or claim 28 wherein the model distances estimates are modified



in dependence on said scale factor to produce a set of modified model distances.

- 30. A network device (200) according to claim 29 wherein the model distances are scaled by the scaling factor to produce the modified model distances.
- 31. A network device (200) according to claim 30 further including means for calculating a difference value for each donor network element (14) and at least one repeater (16, 18), including a summer for summing the difference between each estimate and each modified model estimate obtained for each respective donor network element (14) and at least one repeater (16, 18).
- 32. A network device (200) according to claim 31 wherein the signal is determined to be transmitted from the donor network element (14) or at least one repeater (16, 18) having the lowest difference value.
 - 33. A network device (200) according to any one of claims 18 to 32 wherein a plurality of signals are received from a donor network element (14), wherein all steps are repeated for each such signal to determine a source of each signal.

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34. A network device (200) according to any one of claims 18 to 33, further comprising means for calculating the location of the remote station (20) in dependence on the determined source of the signal.